53 (IE 302) FDIN

2018

FUNDAMENTAL OF INSTRUMENTATION

Paper : IE 302

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions out of* ***seven.***

1. *(a)* Defined active sensor. 2

(b) Describe the significant of linear system. 4

(c) Describe the different standards. 6

(d) If $R_1 = \frac{R_2 . R_3}{R_4}$, $R_2 = 100\Omega \pm 1\%$

$R_3 = 200\Omega \pm 2\%$, $R_3 = 300\Omega \pm 3\%$

Calculate the limiting resistance of R_1. 8

2. *(a)* What is smart sensor ? 2

(b) Explain the advantage of current transmission over voltage transmission. 4

(c) A $200mA$ ammeter has an internal resistance of 10Ω. For extending its range to measure $1A$, find the shunt resistance required. 6

(d) Draw the block diagram of weight measurement system and describe all blocks. 8

3. *(a)* Define intelligent instruments. 2

(b) Describe in brief — the environmental effect on error. 4

(c) Explain the non-linerity effect in potentio meter based voltage divider circuit. 6

(d) The table given below of measure values. Values are 53,54,55,56,57,58, 59 and frequency of occurrences 2,4,6,8,10,6,2. Calculate mean, mode, median; mean abosolute deviation, standard deviation. 8

4. *(a)* Why 4–20*mA* is used. 2

(b) A Buffer can reduce loading effect. Justify the statement. 4

(c) Defined the following terms : 6

(i) Precision

(ii) Accuracy

(iii) Linearity.

(d) Explain temperature measurement using 4 wires RTD. 8

5. *(a)* What are the differences between null type and defection type bridge ? 2

(b) What is loading effect ? Explain. 4

(c) What are the different methods of calibration in measurement ? 6

(d) Using the Chi-square method, test whether the following set of reading follow the Gaussian distribution curve or not. Temperature reading are 75–80, 80–85, 85–90, 90–95, 95–100, 100–105, 105–110. Observe frequencies are 3,7,10,13,9,7 and 4. 8

6. *(a)* Draw the differential amplifier circuit using OP–AMP. 6

(b) Draw the instrumentation amplifier circuit with output equation and advantages. 6

(c) How loading effect reduces in the measurement of temperature using thermocouple ? Block diagram must contain mathematical model of thermocouple, op–amp, meter, etc. 8

7. (a) What is the input impedance of an non-inverting operational amplifier ? 2

(b) Discuss the characteristics of an ideal operational amplifier. 4

(c) A strain gauge has a gauge factor of 3. If it stretches from 0·25*m* to 0·255*m* what is the percentage change in resistance ? 6

(d) In a certain manufacturing process, the length of shafts produced has a mean length of 300*cm* and a standard deviation of 1*cm*. If the shaft diameter range from 297*cm* to 303*cm* is acceptable, how many rejections would you expect in a random list of 10,000 shafts ? 8
